Lower Duwamish Waterway Superfund Site - EPA Comments on Pre-Design Studies Workplan – Draft, dated February 21, 2017

INITIAL comment number	Section and Paragraph	Page Number	Review Comment
1.	General		The work plan DQO bullets are overall objectives and are not at a level of specificity necessary for data quality objectives. The QAPPs will need to form more clearly defined DQOs and involve EPA and stakeholders in the development process for QAPPs other than those related to 2017 field work (surface water and fish/crab tissue).
2.	General		Throughout the document DQOs for the various media indicate that the baseline data will be coupled with long term monitoring to analyze potential trends. However, the work plan and supporting appendices do not specify what statistics will be used for trend analyses and whether the proposed baseline sampling scheme provides a robust enough data set to determine statistically significant trends. Directly address how changes will be evaluated using data sets generated by this baseline sampling approach, either within the body of the work plan or in Appendix A, specifying the statistical approach and demonstrating that the proposed baseline sampling scheme will provide a robust enough data set.
3.	General		Include language in the work plan that acknowledges that this work plan provides a framework for sampling that will be repeated at points during the remedial process, but that the frequency and timing of future monitoring has not been determined as yet. The sampling design for the future long-term monitoring program will need to consider the data and statistical information generated by the current plan, final remedial areas and actions, and potential changes to the conceptual site model, study questions, assumptions, remediation areas, and data quality objectives. It is our understanding that we might need to reconsider elements of the sampling grid/stratification. This will necessitate future revisiting of the data to confirm the assumptions and coordination with EPA on potential modifications.
4.	General and Appendix D		The work plan indicates that in-river studies are likely to continue generating data, apart from what is required under Superfund, that might contribute to our understanding of background and trends towards cleanup. Expand Appendix D to incorporate known sampling efforts (PSEMP, King County tissue sampling, pre-design studies). LDWG may benefit from developing a process for regular updates to the data compilation, and for evaluating whether these data alter our understanding of LDW over time.
5.	Figure 2-1	8	Bringing forward the site conceptual model is helpful, but focuses on physical conditions. Consider showing — separately or on the same figure: -- contamination and how it moves. Some of the physical conditions – sediment deposition, for example – are good if it's clean, not good if it's dirty. Highlight the turning basin, where much of the bedload drops out and is periodically removed. Show suspended particles. Show tidal changes (conceptual) in water depth. Show the navigation channel on the cross section. In the box on the lower left, add 're-deposition' and "relocation". Where do direct spills show up? Show suspended sediments, recirculation of contaminants in living and decomposing biota. The term in the key to strata: upper and lower alluvium. Why is it distinguished from sediment (recent)? Show sediment cleanup?
6.	2.1	9	Clarify: 'Today, USACE generally performs maintenance dredging…' [Preceding sentence is about 'central portion of the river' so please clarify: dredging of what? All areas or just shoaled parts of navigation channel? Turning basin?]. State frequency of dredging of turning basin, also.
7.	2.2.1	10	In light of recent work done by King County and USGS to better characterize the Green River, can more recent information be synopsized in this section based on these studies? Does the USGS information presented by Kathy Conn at 2017 PLA meeting suggest that suspended sediments may not settle in the river? Ms. Conn expects the report to be issued soon and can present the results to the LDW team.
8.	2.2.1	12	What is the (currently estimated) 500-year high-flow event recurrence interval? Is it likely that the previously defined 500-yr high flow event will occur more or less frequently over time? Also, editorial: "~~average~~ flows in the LDW have averaged ~~been~~ approximately 1,340 cubic feet per second (cfs) and have rarely exceeded 12,000 cfs."
9.	2.3	15	"Contaminant concentrations in [insert: filtered and unfiltered] water have greater temporal variability than those in sediment." Also add a statement regarding what causes the variability. Clarify "both the day of and prior to sampling" – is this a day prior to sampling? Or other (immediately prior to? A week prior to?). "The PCB concentrations in surface water increase from upstream to downstream…" – Clarify that this is water in the surface layer, for consistency with other parts of the paragraph (surface water is a broader term). "In addition, local runoff influences surface layer concentration patterns." Replace local runoff with "lateral sources" or list other influences on surface layer concentration patterns.
10.	2.3	16	"The metals data suggested that differences in concentrations across the waterway were small, even in transects located near large CSOs." More detail should be provided on issues with the auto sampler and PCB results and to show that the conclusion of a horizontally well-mixed water column is valid.
11.	2.3	16	The data cited for 1996, 1997 and the 1999 KC report are too old; they do not meet the data management rule from the third amendment to the AOC. Are there more recent data that confirms the conclusions made with the 96, 97 and 99 data?
12.	Figure 2-3 (graphic)	16	This is helpful, but perhaps oversimplified. In addition to runoff, show other sources, such as discharges from CSOs and other outfalls, spills/leaks, erosion/resuspension of particulates, and (maybe as dotted line?) groundwater. EPA recognizes that not all sources are addressed by this work plan, but for completeness they should be included.
13.	Figure 2-3 (graph)	16	Include number of samples (n).

14.	2.3	16	"…differences in concentrations across the waterway were small" – this references metals and infrequently detected SVOCs, but not PCBs. PCB data that could be used to assess lateral mixing appear limited to Green River sampling results. Discuss what physical monitoring results are available or might be obtained to validate this assumption.
15.	Footnote 12	17	Based on the text above, it appears that the King County data are from Green River only. If so, correct footnote to read: "All parameter concentrations, except PCBs, were found to be similar across the ~~waterway~~ Green River."
16.	Table 3-1	20	The text indicates the data quality information for upland and upstream data was summarized if present. Please provide a footnote indicating why Data Quality Review was not conducted.
17.	3.2.1	20	This introductory section is misleading, as it introduces two compliance intervals for sediment and references RAO3 but is followed by five subsections about sampling, only one of which is introduced here. ("In addition, specific source-related sediment sampling will be conducted…"). Introduce the five subsections, and leave discussion of compliance intervals in the relevant subsection. Reference the third amendment to the AOC in a way that it relates to all of the subsections of 3.2.1, not just the source-related sampling.
18.	3.2.1, General		While assessing compliance with cleanup levels and target tissue levels is the primary intent of baseline and long term monitoring, and these levels are largely applicable site-wide, until remediation is complete, and in subsequent monitoring events, we recommend preserving a finer degree of granularity to show the effect of cleanup before it shows up in the site-wide average and to guide analysis and potential adaptive management of the site in the long term.
19.	3.2.1.1, General	22	The DQOs listed are very general/high level (lifted or modified from AOC SOW). More detailed DQOs are required in the QAPPs. See individual sections for specific comments. DQOs for all media need to be more thoroughly defined and developed using a systematic planning process. Detail should be included to support each of the overall objectives currently stated in the work plan. While EPA is not recommending use of the UFP QAPP format, the following steps out of the UFP QAPP should be followed in a systematic process and fully articulated in the work plan and/or QAPPs. (We recommend a table with the following column headings) 1. State the Problem. 2. Identify the Goals of the Study. 3. Identify Information Inputs. 4. Define the Boundaries 5. Develop the Analytic Approach. 6. Specify Performance or Acceptance Criteria. 7. Develop the Detailed Plan for Obtaining Data.
20.	3.2.1.1	22	Revise text based on the following edits: "The DQOs for the ~~collection and analysis of~~ [replace with: establishment of baseline conditions for] LDW surface sediment samples (0-10 cm) are as follows: • To establish [replace with: current] ~~baseline~~ site-wide 95% upper confidence limit for the mean (95UCL) concentrations of [insert: RAO 1, 2 and 4] risk drivers ~~to achieve RAOs 1,2, and 4~~. • To establish [replace with: current] ~~baseline~~ site-wide spatially weighted average concentration (SWAC) to serve as the foundation for assessing trends ~~following sediment remediation~~ for RAO 1,2, and 4 risk drivers.
21.	3.2.1.1	22, 23	Baseline for MNR and ENR areas and compliance with RAO3 are not addressed by this plan. While the other DQOs are listed, make the omission more explicit. The purpose of sampling described in Section 3.2.1.2 needs to be explicitly qualified, as MNR boundaries have not been finalized. Plans for baseline sampling for evaluating natural recovery and compliance with RAO3 will be developed during remedial design. Here and in section 3.2.1.2, clarify that the purpose of the discrete samples in MNR areas is to observe site-wide trends and changes in surface sediment quality over time and to support comparisons of actual to predicted natural recovery since sampling was last conducted during the RI/FS phase. These are the only objectives that should be established for the discrete sampling in MNR areas. 'Point-by-point comparison of concentrations in baseline sample collected from within MNR areas to the (benthic) cleanup levels presented in the ROD Table 20' will not be used to delineate areas or assess MNR area compliance with RAO3. Twenty discrete samples are not sufficient to assess compliance with SMS criteria (RAO3) and a more robust sampling scheme will be needed for long term monitoring once construction is complete.
22.	3.2.1.1, 1st paragraph	22	"Baseline will be established based on data from a single sampling event" – Again, clarify - baseline for RAOs 1,2, and 4 only.

23.	3.2.1.1	23	UCL95 based upon a data set of size 30 will yield a more accurate and precise estimate of the site-wide average (key objective of the baseline sampling plan). Divide the 5 RMs into 150 equal segments, and analyze 30 composite samples comprised of 5 sub-samples (grabs), with one grab sample each from 5 contiguous segments of equal size (area). Each composite sample thus obtained will approximately cover 0.1667 miles (See Table 3). These composite samples will address small scale variability (heterogeneity) and preserve spatial information.	
24.	3.2.1.1, 3rd paragraph	23	Per discussion during our meeting on March 1, the 10 sampling locations are not randomly selected. The text needs to be corrected and can be referenced to Section 3.2.1.2, the study design and rationale.	
25.	3.2.1.1, 9th paragraph	25	The text states congeners will only be analyzed if PCB Aroclors are not detected. Revise to include analysis of congeners in a subset of samples. Archive all samples to preserve the option to obtain baseline data for congeners.	
26.	3.2.1.1	25	Clarify this sentence phrasing "If all PCB Aroclors…" Does this mean if a sample doesn't detect each of all Aroclors or if there are no Aroclor detections?	
27.	Table 3-2, footnote a	25	"*All of the cleanup levels* are LDW-wide values with a compliance depth (0–10 cm) with a 95UCL compliance measure." Cleanup levels determined for clamming direct contact exposure are for intertidal clamming habitat. Cleanup levels for beach play are at the level of individual beaches. Correct the footnote and table title to reference surface sediment only.	
28.	3.2.1.1 last paragraph	25	Cross reference section 3.2.1.3 which identifies the protocol for determining the relationship between total PCBs determined using the Aroclor and congener methods.	
29.	3.2.1.2	25	This section references Appendix D, the table of anticipated data needs, labeled a "preliminary draft working document". EPA comments on Appendix D are extensive. Even after the comments are addressed and the work plan is approved, this table will be considered a working document, not a final determination, as remedial phasing and new information may warrant changes.	This section working docu and the work as remedial p
30.	3.2.1.2	25	First DQO should refer to "potential" MNR areas because the sample design is based on the pre-ROD data, which will be confirmed during the pre-design and design stages.	
31.	3.2.1.2	25, 26	(See comment on 3.2.1.1) Clarify that the purpose of the discrete samples in MNR areas is to observe site-wide trends and changes in surface sediment quality over time and to support comparisons of actual to predicted natural recovery since sampling was last conducted during the RI/FS phase. These are the only objectives that should be established for the discrete sampling in MNR areas. 'Point-by-point comparison of concentrations in baseline sample collected from within MNR areas to the (benthic) cleanup levels presented in the ROD Table 20' will not be used to delineate areas or assess MNR area compliance with RAO3. Twenty discrete samples are not sufficient to assess compliance with SMS criteria (RAO3) and a more robust sampling scheme will be needed for long term monitoring once construction is complete. Page 26, insert baseline as follows: "reference to more intensive baseline characterization relative to RAO 3 and location-specific evaluations"	
32.	Table 3-3	27	HCB reporting limit is above the cleanup level and should be shaded.	
33.	Table 3-3	27	Include PCB congeners with Method and RL	
34.	3.2.1.2, 2nd paragraph	28	HCB RL is above the cleanup level. Discuss how the data will be evaluated.	
35.	3.2.1.3	28	State that this evaluation will include any Aroclor NDs that result in archived congener evaluations. Clarify what "suitability" criteria will be used to support this evaluation (second to last sentence in this section). For this evaluation to be more useful, evaluate congener and specific Aroclor comparisons rather than (or in addition to) total PCBs.	
36.	3.2.1.3	28	For defining Aroclor/congener relationships, consider the implications of analyzing discrete samples from areas potentially affected by different PCB sources versus analyzing composites of such samples. Specify which approach (or both) will be selected and why, for discussion at a work plan comment resolution meeting prior to QAPP submittal. Also, this specifies that the sum of detected Aroclors and congeners will be compared. Discuss the basis for comparing the sum of detected congeners and Aroclors only. Consider additional ways to compare the data.	
37.	3.2.1.4	28	Modify DQO phrasing to read "To establish baseline 95UCL concentrations of human health risk drivers for RAO 2 across all potential clamming areas identified in the ROD." Note that the designated surface water use for "harvesting" is site-wide and is not limited to the clamming areas identified in the ROD.	
38.	3.2.1.4, Clamming Areas	29	Modifications need to be made to have each sampling location represent equal area, per standard multi-incremental sampling procedure. Additionally, multi-incremental sampling needs to also be implemented during laboratory processing of the samples prior to analytical testing.	
39.	3.2.1.4, Sampling and Analytical Methods	29	The preferred approach would be to collect a large diameter core sample, rather than digging a hole with a shovel. This method will help preserve the fines associated with porewater and will also provide a more representative sample by depth. The shovel/spoon method is a suitable back up for beaches too cobbly to core. We anticipate sampling details in QAPP. Further, three separate cores (or holes dug with shovel when necessary) should be collected within close proximity to each other rather than collecting the three separate samples from the same core/hole in order to avoid inadvertently collecting replicates. This comment is also applicable to the 45cm interval sampling methodology for beach play areas.	

40.	3.2.1.4, Beach Play Areas	30	EPA is concerned the sampling scheme for beach play sediment may not yield a data set, that, via application of the Central Limit Theorem, can be assumed to be normal. Derivation of UCLs is based on this assumed normality. Provide further justification of the proposed approach, particularly as it pertains to the CLT and assumption of normality. If the existing beach play sediment sampling approach will not yield data that can be assumed to be normal, EPA requests that either a revised sampling approach be developed, such as multi increment sampling, that will yield data that can be assumed to be normally distributed, **or** an alternative statistical approach to compute UCLs be proposed that does not rely on the assumption of normality. (See also last sentence of comment above).
41.	3.2.1.5 Source Related Sediment - General		Ecology and EPA are available to consult on the process of identify suitable sample locations, with support from Leidos until June 30. A field reconnaissance is appropriate and should be planned for the near future (and potentially could be combined with planned work under Task 7 Waterway Users Survey and Structures.
42.	3.2.1.5, last paragraph, footnotes	32	Add to listed considerations for additional sediment sampling: for outfalls where source control measures have been put in place, whether sampling has demonstrated that they are effective. Footnote 32. Cite or support the basis for the criteria listed (50 feet, 100 feet). "Are there existing data" – Data may exist but be out of date or insufficient. Footnote 33. Physical obstructions should be reevaluated during reconnaissance to assess whether pilings/overwater structures are still in place and that they truly prevent access for this type of sampling (e.g. a dock may not necessarily preclude sampling depending on access method). Where rip-rap prevents sampling, the report should summarize what is known about the size, rip-rap placement history and adjacent properties.
43.	3.2.1.5, Figure 3-1	33	The flow chart criteria are too vague. Specific criteria will need to be identified in the revised Work Plan and referenced in the figure. Clarify that, in the QAPP, the result of the application of the criteria should be presented, with specific sample locations and sampling/analytical details. In particular the box "Has source control already been conducted for this outfall" is unlikely to be relevant. Source control actions are varied and numerous. Suggest adding to the source control box, "and been shown to be effective" or similar. Again, the QAPP will need to define the criteria used to determine source control has been determined complete/effective.
44.	3.2.1.5, 1st paragraph	34	This references 3.2.1.1 sampling methods. Verify that source related samples will not be composited. Note that more than one sample may be needed near a given outfall.
45.	3.2.1.5, 5th paragraph	34	Confirm that the QAPP will clearly define the method and criteria for determining whether a bank can be sampled – or include here.
46.	Figure 3-2	35	"Are there existing sediment data in the vicinity of the bank, and if so, do the data indicate that the bank is not of concern?"- Define "is not of concern." Does that mean there is no source? "Is the bank adjacent to an EAA or dredge/cap remedy?" Why is this relevant? Does this imply that the bank no longer has a source, that is has been characterized, or that the bank was cleaned up as part of the EAA/dredge cap remedy? Please clarify figure.
47.	3.2.1.5, Figure 3-2	35	Change criterion "Is the upland property a listed site". Instead, refer to a formal cleanup site under or expected to be under an Agreed Order (a note at the bottom of the figure may be helpful).
48.	3.2.1.5	36	Clarify the conditions that would trigger dioxin/furan analysis. Specify what is meant and provide specific criteria for "…if nearby sediment quality indicates a potential nearby source, or if upland operations suggest a potential source." Editorial: other criteria outlines (should be outlined)
49.	3.2.2		The AOC amendment 3 calls for PCB congener analysis in a subset of tissue samples. The work plan does not provide an explanation for analysis of 25% of the samples for PCB congeners. Baseline and future congener data in tissue may be used to understand PCB sources, to refine health communication and inform institutional controls, and to observe changes in congener relationships in tissue over time. The Washington Department of Health prefers congener data (for dioxin or PCBs) because it allows them to assess additive TEQ of dioxin-like compounds. Combining results by Aroclors may overestimate the total concentration of PCBs (10-20%).
50.	3.2.2		We recommend congener analysis on 5 samples per reach for English sole, Dungeness crab, and Shiner surfperch. It will help ensure a good baseline should trends favoring congener analysis, which are likely to continue, become the primary focus of monitoring. Health agencies will use congener data when updating health advisories. For the Shiner surfperch, congener analyses may also shed light on differences in PCB sources and weathering processes in the waterway. The additional sampling for congeners will allow calculation of a UCL95% by reach, not just site wide.
51.	3.2.2		Verify that the approach to compositing hepatopancreas from 10 crabs with the two samples of edible meat, composited from the same 10 individual crabs, is what was done in the RI to develop the target tissue levels. Ensure that the QAPP addresses measurement and reporting of the weight of hepatopancreas and edible tissue for each individual crab. The crab sampling should target harvestable crabs (males over a certain size, with hard shells).

52.	3.2.2		Graceful crab is not considered a suitable backup species, given that their diet differs from that of the Dungeness crab. There may be Red Rock crab in upper reaches, and we should discuss whether to use it as backup or whether other contingencies are available. An understanding of the required level of effort prior to changing to the backup species should be included and, if appropriate, the costs of continuing to sample for Dungeness crab might be helpful.
53.	3.2.2		If WDOH were using this or similar data in future to update the fish advisories, they would recommend analysis of five composites of five fish per species per location per size class (if the sizes of fish vary). If the sentinel species indicated that fish are less contaminated, WDOH would suggest testing other species to see if they are lower as well. The sentinel species would not be extrapolated to other species for purposes of changing the advisory. Given expected reductions in PCB contamination in sediments, due to source control efforts and early action area cleanups, a baseline for PCB congeners for the sentinel species is needed.
54.	3.2.2		Provide more specificity as to what approach will be used to analyze trends in tissue concentrations.
55.	3.2.3.2 Clam Tissue		EPA generally agrees with the approach for clam tissue analysis presented.
56.	3.2.3.2 (Text and Table 3-6)	42-43	For the analysis of human health COPCs other than the four COCs, rather than selecting one clam tissue from one clamming area within each of the three river segments, all clamming areas within each segment should be composited.
57.	3.2.3.2	42-43	In addition to analysis of clam siphon skins for arsenic, include cPAH analysis of clam siphons. Given the lack of literature regarding the potential for cPAHs to preferentially accumulate in siphon skin, and given the weak regression relationship of clams to sediment for cPAHs, an initial round of siphon skin analysis for cPAHs should be added. If baseline sampling shows no preferential accumulation in the siphons skin for cPAHs, separate analysis for cPAHs in siphon skin can be reduced or eliminated from future monitoring. This request to include cPAH analysis of siphon skins could be resolved either within section 3.2.3.2 of the work plan that is the subject of these review comments or in the porewater addendum.
58.	3.2.3.2 (Text and Table 3-6)	42	Analyze 6 of the 11 clam composite samples for PCB congeners for same reasons cited for fish and crabs.
59.	Table 3-6	42	The cPAH and dioxin/furan RLs exceed TTLs. Please discuss previously determined concentrations to evaluate how much of a problem this will be. If ambient concentrations are below proposed method RLs, please discuss alternate analytical methods or procedures that might improve RLs.
60.	3.2.4		The AOC3 SOW calls for a statistically based rationale for the number of samples of each sampled medium, compositing schemes, and locations. This was not set forth in Appendix A or in the work plan.
61.	3.2.4		Locations: While the AOC3 SOW sets out an expectation for samples in three LDW reaches, it also notes that the approach will be revised as necessary based on the DQOs. The DQOs in Section 3.2.4 are to assess progress following sediment remediation and continued source control and to establish baseline conditions for long-term monitoring. It's not clear specifically how the data will be used for these purposes and the sampling locations are not specified in the work plan. Are the three reaches specifically intended to show changes related to cleanup and source control in those reaches? Are the samples taken near the bottom intended to demonstrate progress related to sediment cleanup, while the near surface freshwater samples likely to reflect changes to lateral sources of contamination? What role will CSOs play in the siting of surface water sample locations? If temporal variability related to storm flow and other physical events are likely to have a greater effect on concentrations than location along the river channel, consider whether establishing baseline with more statistical confidence can be achieved with more analyses at fewer sample locations.
62.	3.2.4		Specific locations are not proposed in the work plan, but factors listed for locating samples include past sampling locations and position relative to major outfalls. Given the discussion of the conceptual site model, were the locations shown in Figure 2-3 (RM3.3, RM1) considered? Is there a reason to select a sampling location where sediments are contaminated enough to require active cleanup?
63.	3.2.4		Frequency: Sample for at least 2 (not 1) storm events without significant dam release and at least 2 (not 1) storm events with significant dam release.
64.	3.2.4		Provide a reason why the 4-hour period bracketing high tide is selected over low tide or other tidal conditions?
65.	3.2.4		Ensure that sampling occurs on the same day. With two LDW locations this may be more manageable.
66.	3.2.4		Rather than seeking to reduce the analyte list after just 2 sampling events (first storm event and baseflow), expect to complete all of the 2017 sampling, including at least 2 storm events without dam releases (per USGS, these may be expected to show higher concentrations), before proposing changes. This will provide something closer to worst case conditions and more data for EPA to consider reductions. Note on page 48 that "will be deleted…in consultation with EPA" should be "may be deleted… if approved by EPA."
67.	3.2.4		Why is the Hamm Creek rain gauge proposed? Could the King County airport provided more useful information? Hamm Creek rain gauge and flow relationship may not be sufficiently established. Explain whether the timing is intended to capture peak flows in LDW, the rising limb of the hydrograph, or something else.

68.	3.2.4		The QAPP will need to include contingencies for any missed events at any sample location and clarify that the near-bottom sample will be collected, regardless of the salinity.
69.	3.2.4.2	47	Revise as follows: First paragraph: 'Two composite ~~grab~~ samples …' (composite is meant, I believe. If so, delete grab). Third paragraph: Multiple {or state #} g~~G~~rab samples will be collected ~~combined to create a composite for~~ at each sampling depth (i.e. near-surface and near-bottom) and composited into one sample per depth at each location. ~~One composite sample will be collected at each depth at each LDW location for each sampling event (i.e. one near-surface and one near-bottom sample).~~
70.	3.2.4.2 Footnote 48	47	"AWQC that are relevant and appropriate include only those that relate to consumption of organisms." The AWQC include criteria for protection of aquatic life, and these are also relevant and appropriate.
71.	3.2.4.2	47	EPA agrees that VOCs do not need analysis. However, the 7 organophosphorus compounds and two herbicides should be analyzed for before a decision is made about eliminating it from the list for future analyses.
72.		48	See comments on reduction of analyte list in our comments on SW.
73.	3.2.5 - Seeps	48	• Similar to comments on Figures 3-1, this flow chart is vague. Footnotes and additional detail should be added to the work plan • Address what it means for a seep to be considered sampleable as well as what criteria will be looked at to determine if the seep has been previously sampled (age of the data, analytes analyzed, etc.). • Similar to the comment on Figure 3-2, change criterion "Is the seep adjacent to a listed site". Instead, refer to a formal cleanup site currently under or expected to be under an Agreed Order (a note at the bottom of the figure may be helpful). • Explain how timing of seep sampling will work. QAPP due date is triggered by work plan approval. Low tide reconnaissance at all locations – June 2017? Sampling, May/June 2018? • Does it make sense for existing data to be reviewed before reconnaissance? (Note: Ecology's groundwater sampling results should be available no later than June 30, 2017) • Reconnaissance "within a month of" sampling (rephrase: no more than 30 days before sampling"). Where does QAPP review fit in? • Clarify that all samples will be tested for the COCs from Table 19 and 20, unless different or fewer analytes can be justified based on sample location. • How does "sampleable" get assessed during recon? • Salinity – field measured as conductivity? (is there any way to use conductivity meter to assess groundwater influence near bulkheads? • Ensure clear documentation (photos, notes) of what makes the location not sampleable. Text in this section is also too vague. It is best if a tech memo that describes what was observed during the reconnaissance and the outcome of other steps in Figure 3-3 precede the QAPP (as these may affect locations, analytes, etc). The memo would propose specific sample locations based on this evaluation. Add this, or discuss how otherwise to reach agreement on the specifics of sampling following reconnaissance.
74.	3.3 Sampling & Analysis	50	Footnote 50 notes that EPA and LDWG will need to negotiate a modified schedule. The approved timing should be set forth in the final work plan. If an extension is needed, a request should be initiated soon.
75.	3.3	52	Figure 3-4 – Field reconnaissance should be shown, unless it is to be completed prior to August 2017.
76.	3.4 Sample Repts	53	a. Surface Water: 'Validated data will be submitted to EPA after each interim sampling event.' State that what will be provided includes not just surface water data but all information that will ultimately go into the data report, described below the bullets. b. 'Maps in the data report will only include sample locations.' Describe what will be provided for fish and crabs. "Sample location" information is not enough. c. Rather than waiting more than a year from August 2017 for the data evaluation report, consider presenting a writeup of field information and relevant statistics for fish and crab earlier. d. Data can be provided in SCRIBE. Please check that SCRIBE is appropriate for all the data types (congeners, e.g.). e. When and how will LDWG recommend reductions in the analyte list for surface water? Results of sampling to support Ecology's source control work may need to be provided to Ecology ahead of the data evaluation report. Provide a schedule for discussion with EPA, to be included in the revised work plan.
77.	3.5 Data Eval Rept	53	First bullet: DQOs described in the QAPP will need to be much more detailed than the bullets at the start of each subsection of 3.2. No change to work plan required.
78.	3.5	53	Clarify whether there will be one report or a separate data evaluation report for each task. The latter may be preferred. The Work Plan indicates that data reports will be released with each task, but the reporting is unclear.
79.	3.5	54	The first bullet limits data used for comparison of BCM input parameters to data from Tasks 2 and 4. If additional relevant information becomes available following Task 2, describe how it will be identified and considered.

			The last bullet notes that LDWG will compile a list of any new datasets added to the LDW database since the Task 2 data compilation. What about new datasets not added to the LDW database? Tracking new data and updating the data compilation periodically would be a good idea. Please discuss recommendations for an appropriate frequency of or key milestones for compilation of new site data. EPA hereby requests LDWG support in making the GIS map accessible via the Internet. Please add to a meeting agenda.
80.	3.8 Recovery Category Rec Rept	56	Add "current" before "vessel movement". Potential scour areas are important, but spudding practices and chain drag must also be addressed in comparing to the recovery category maps. Provide reference the specific recovery category maps cited.
81.	3.8	56	Last paragraph in section implies that recovery category recommendations developed in this report will include considerations of empirical contaminant trend data collected/summarized as part of the Task 2 data compilation. Please provide more information on how LDWG anticipates using chemical data (from Task 2 compilation and work plan) to initially propose adjustments to recovery categories assigned in the ROD.
82.	3.8	56	Identify data gaps that may remain to fully assess empirical contaminant trends area by area, and clarify the timing of data collection in the revised work plan. Table 23 calls for sediment cores and resampled surface sediment locations. Filling these data gaps may be on the critical path for remedial design, particularly in the upper third of the waterway. Note that a USGS study (expected to be released shortly) and local features (presence of fine grained sediment, for example) should be considered in how the sedimentation rate estimates modeled for the waterway are applied locally.
83.	3.9	57	"No such data needs were identified" – EPA is concerned that the data necessary to finalize recovery categories may require more time than is anticipated during the remedial design phase. Empirical observations suggest that some areas are not experiencing sedimentation as expected and assessing local sedimentation and contaminant trends may take time. USGS work may suggest that additional information is needed. This should be discussed with EPA.
84.	4, Schedule and Deliverables, first para	59	Delete the last sentence in the first paragraph of Section 4. If additional documentation becomes necessary, even though EPA will almost certainly coordinate with LDWG, what EPA can require is governed by the terms of the AOC.
85.	Table 4-1	61	a. EPA may approve certain elements of the Work Plan to keep time critical work moving forward. In this instance, the QAPP for a given work element would be due 45 days from EPA approval of the relevant portion of the Work Plan. b. While generally consistent with the AOC schedule, Table 4-1 indicates that LDWG's initial proposal of phased QAPP submittal has been modified. How does LDWG see this in relation to the 2-21-2017 Gannt chart? c. Footnote b and c suggest that LDWG will propose schedule modifications. To ensure the final work plan schedule is as up to date as possible, provide an update of the 2-21-2017 for discussion prior to the next submittal. d. Revise Task 3 draft seep QAPP to be due 45 calendar days after *EPA comments* on groundwater data compilation.
86.	All Appendices		Editorial: please revise page numbering to distinguish appendix page numbers from main text page numbers.
87.	General and Appendix A	A1	Revise Appendix A to address Anita Singh comments (provided previously and again herewith) and incorporate or append additional statistical analyses LDWG performed. Modify Section 1.1 to reflect changes in the surface sediment sampling approach. The text (for example, bottom of page A1) mentions that future sampling will use the same grids and same stratification as used in this baseline data set. Change text to acknowledge that changes to the future sampling approach may be warranted as additional information develops. Check the text of Appendix A for the term "will" and qualify appropriately (e.g. "would" or "would likely")
88.	Appendix A, Section 1.1, 3rd paragraph	A1	This reports the RME as 25%, which is inconsistent with the text in the report which references 15-20% RME. Ensure that Appendix A is consistent with the text or explain the difference.
89.	Appendix A, Section 1.1, 5th paragraph	A1	Include a decision tree for the random sample locations within a cell (similar to flow charts for other media). Eg. Is the random location accessible? Is it unacceptable in some other way (obstructions, grossly unrepresentative etc?). Provide details.
90.	Appendix A, Table 1	A4	Include the concentration ranges for cPAH and As.
91.	Appendix A		Calculating 95% UCL for tissues, beach, and clam areas with only 3 samples provides a potential for an unacceptable low level of accuracy. While 3 composite samples should be sufficient based on the assumptions outlined in the appendix, if results contain non-detects of if the data points are clustered in such a way that does not depict a normal distribution, the 95%UCL could prove unreliable. Suggest increasing the number of composites to help improve the robustness of the calculation for this baseline round of sampling. Decreasing this number of composites could be considered in future monitoring years.

92.	Appendix A		In Appendix A, Section 6.2, the one high Dungeness Crab whole body data point was excluded from the CV used in calculating the distributions for the RME vs. sample number comparison, resulting in an expected CV of 0.2. As indicated in Section 4.2 of Appendix A, the 2004 and 2005 data for Dungeness have a much lower CV than the 2007 data. Each of the data sets all had a low number of samples (2004: n=7; 2005: n=3; 2007: n=4). It's possible that the CV was simply under-sampled. It is better to include the outlier, which results in a CV of 0.44. According to Figure 6, for either the normal or gamma distributions, 12 composite samples would then yield an RME of between 0.2 and 0.3. This may not require a change in the proposed sampling. Though the RME of 25% may not be met, it should be close.
93.	Appendix A		If the baseline data indicate that the CVs were underestimated, how and when would the number of tissue composites or number of samples per composite be adjusted to account for that?
94.	Appendix A		Include tabulated summary statistics (sample size, mean, sd, mix, max, number of NDs etc.) for all segments/sub-groups individually and combined used in the bootstrap exercise described in Appendix A.
95.	Appendix A		It is not clear if the bootstrap exercise described in Appendix A is based upon the same number of samples in all segments. Without this information, the correctness (normality, CV calculations, and spatial independence) of bootstrap results cannot be assessed.
96.	Appendix A		Were there enough samples in each divided segment to perform bootstrap? When a segment contains less than 10-15 samples, bootstrap will yield samples with low variability - due to repetition of same observations in simulated bootstrap samples.
97.	Appendix A		For consistency, the data sets (all segments data sets) to be bootstrapped should have the same number of samples. Is this requirement satisfied? It seems like this may not be the case due to the use of 200 feet distance between samples to achieve spatial independence of results. Also, the current conditions (independence etc.) at the LDW site might be significantly different from those observed during the 2007 remediation investigation (RI) study.
98.	Appendix A		If the requirements described above to perform bootstrap methods are not satisfied, the resulting bootstrap statistics (e.g., GOF test results, CVs, means, and standard deviations) could be meaningless/unreliable. LDWG determined normality and computed CV based upon unverifiable bootstrap results.
99.	Appendix A		Due to the deficiencies described above, for verification purposes a request was made (January 18 Comment Report) to provide all available sediment data (from 2007 RI study) used in the bootstrap exercise described in Appendix A.
100.	Appendix A		The following paragraph is taken from LDWG Appendix A: "The targeted precision goal for the site-wide mean estimate for sediments is 25% (similar to analytical uncertainty). The sampling objective to estimate the LDW-wide mean with this precision can be met most cost-effectively through the use of composite samples." As stated in the previous Comment Letter, the above paragraph has technically incorrect statements. The WP and Appendix A are using both variance and percent (%) relative error margin (% relative departure from the unknown true mean) to represent the precision in the mean estimate. Variance (standard error) is used to estimate the precision and % relative error margin (% REM) is used to determine the accuracy in the mean estimate. 25% REM does not represent the precision.
101.	Appendix A		Please update Appendix A to address comments provided by Anita Singh, including Table 5, and incorporate the additional statistical analyses provided to EPA to support fish and crab and surface water . For sediments, it is not reasonable to assume that the baseline data of 20 composite samples from 20 segments (of 5 sub-segments each) will be normally distributed. GOF tests should be performed on the real final sediment data set and appropriate statistical methods (accounting for nondetects if any) should be used to compute the site-wide averages (e.g., UCL95s). Some possible scenarios for sample sizes as a function of CV and % REM are provided below in Table 2 (see table below). All relevant summary statistics should be computed based upon the available sediment data collected during 2007. Based upon the CV, standard deviation (sd, s) of raw data, CV for the composite samples can be computed using the following equation: CV of composite samples of 5 individual samples = s/[mean* sqrt (5)]

			Based upon the CV obtained using the above equation, one can compute the sample size using the scenarios described in Table 2, below. For an example if CV =0.7, then for % REM of 25%, sample size for baseline sampling will be 30; when CV=0.6, then for % REM of 20% (25%), the sample size will be 35 (23). **Table 2. No. of Sediment Samples** CV % RME 0.5 0.6 0.7 0.8 0.4 15 43 62 84 109 28 20 24 **35** **47** 61 16 25 16 **23** **30** 40 10 Also, while developing a sampling plan, it is important to consider area covered by a single composite sample. Compositing is useful to address small scale variability. One should consider if a composite sample covering a smaller area (e.g., 0.167 miles) is more representative than a composite sample covering a larger area (e.g., 0.25 miles). Collecting composite samples over smaller areas (.166 miles) will preserve spatial information better than samples covering larger areas (0.25 miles). This information can be very useful to address future objectives described in AOC, Amendment 3. **Table 3. Miles Covered by a Single Composite Sample** **# Composite Samples** **Area Covered by 1 Composite** 20 0.25 miles 25 0.20 miles 30 0.167 miles Moreover, a UCL95 based upon a larger data set (size 30) will be more accurate and precise in comparison with a UCL95 based upon a smaller data set (size 20).
102.	5.3	23	As noted, it's not clear why invoking the CLT is justified. Use of MIS or a non-parametric method is recommended.
103.	Appendix B		Appendix B Tables 1 – 5 should have column or footnote regarding RL goals relative to CUL or target tissue levels. This applies to similar tables in the main body of the work plan also.
104.	Appendix B		Table 6. Update the SW criteria in Table 6. Back check all values and empty cells in this table. Include the new federally promulgated human health criterion for PCBs. The MDLs should be presented in conjunction with the RLs. If the value represents the PQL or value below the PQL, please note. Include a discussion in the work plan text and/or QAPP regarding how this data will be used/interpreted in light of the significant number of chemicals that have RLs above one or more of the criteria. A revision of this table was provided separately to address the first part of the comment above. Further comment was provided, which should be addressed in the revised work plan. • The table includes freshwater criteria and marine criteria for aquatic life, and the marine only (organism only) column for human health. The freshwater aquatic life criteria are not relevant. In the ROD it is stated that the LDW is considered marine due to its brackish condition (See page 34 of the ROD). See also a Brackish Water guidance that clarifies the translation between freshwater designated uses and marine designated uses, here: http://www.ecy.wa.gov/programs/wq/permits/ApplicationWQCriteriaBrackishWaters.pdf • Table 6 footnote "a" is not technically correct. Ecology has created a version of a 201A publication that incorporates both the WA adopted criteria and the EPA promulgated criteria in one place. https://fortress.wa.gov/ecy/publications/SummaryPages/0610091.html Table 240 has the numbers and there is a one page description of Table 240 at the front of the table that describes the federal action. Note that references to the NTR at 40 CFR 131.36 are no longer applicable. The NTR at 40 CFR 131.45 is the comprehensive human health criteria rule for WA State. • Please check the criteria values.
105.	Appendix D		Include a title. Ensure that the title and footnote make it clear that EPA approval does not include approval of the sampling described.

			While the table is helpful, it is—necessarily--incomplete. Additional data needs may emerge during future phases of work. Add a footnote that indicates that EPA approval of the work plan does not signify approval of Appendix D or limit EPA determinations regarding the timing and nature of additional data collection. The organization of the table and grouping of topics is a little confusing: clarify what is meant by environmental concerns, for example. Item 1 – Under Data Collection Activities, baseline for MNR areas should be included. It may belong on a different line, but should not be omitted. Under Timing Considerations, since ROD does not limit baseline characterization for RAOs 1, 2, and 4, ensure that this is correct. Item 2 – Include trend data for recovery category finalization (See ROD Table 23). Add checks to the three columns to the right of pre-design studies. Show what information needs may be related to compliance with ARARs such as Section 408, 404, and archaeological requirements. Item 4 – "Evaluate need for" is not a data need. Please move this line adjacent to #6. Item 10 – typo: dredge cap prism design? Please correct. Clarify what is meant by water depth constraints. Include a line that assesses reduction in exposure (followup to Fisher Study and IC work). Item 11 – Address the need for information to support Section 13.2.1.3 of the ROD. While it is not clear which structures have contaminated underlying sediments, it is highly likely that some of the structures do. Describe (and include in the design strategy recommendations report) how and when this requirement will be addressed. Item 13 – Sediment transport processes and erosion/scour processes. Include spudding and other disturbances. How will the phases of work incorporate new data—for example, changes in operations or new data regarding Green River depositional rates or sediment quality? For purposes of this work plan, modify the table to show that Items 15 and 16 start in the pre-design studies phase and continue at increasing levels of detail through remedial design investigation phase and beyond. Timelines for permitting, facilities planning, and input from stakeholders/community argue for starting this as soon as possible. The design strategy recommendations report should identify estimated space requirements and haul routes and how they may be addressed. Add a column for long term monitoring. Please include a footnote that states that the remediation schedule and phasing may mean that such monitoring may start before all remediation is completed, and note that some data will be needed to support 5 year reviews. Include in a footnote that the data collection will need to include effectiveness monitoring, which could involve assessing the amount and characteristics of media coming from upstream or ongoing sources.
106.	General, Appendix D and Section 3.9		With the many sampling phases and purposes listed in Appendix D or yet to be identified, information will continue to be generated that is relevant to the site. On a scale finer than what is contemplated in the current baseline sampling, post-construction monitoring or natural recovery baseline will certainly be needed, but in addition, as new information is generated by LDWG or others, tracking, evaluating, and incorporating the new information will be important to a full understanding of site conditions, source controls, remedy effectiveness, biological processes, localized recontamination, risks, and factors in natural recovery. Discuss in Section 3.9 how the design strategy recommendations report will propose tracking and integration of various information sources.
107.	Map 3-10		Part of Clam Tissue Area 10 overlaps with the Terminal 117 EAA sediment remediation. It is unlikely that enough time has passed for the benthic community to reestablish there. Discuss how this will be considered in sampling and data evaluation. Indicate whether Clam Tissue Area 11 overlaps with the AC Pilot Study test plots/intertidal plot. Discuss how this will be considered in sampling and data evaluation.
108.	Maps, e.g. Map3-4		Adjust all maps as necessary to reflect changes to the work plan. For example, Map 3-4 should show equal areas associated with each sample. As was provided in the Annotated Outline, include a small table with numbers of samples and analyses on the figures, as this helps clarify what the figure shows.